smartprocess
control & instrumentation

User Manual

v1.0

SMARTconnect X835
MULTIFUNCTION POWER MONITOR

1 Introduction

The multifunction panel meter SMARTconenct X835 is a top, new-generation intelligent panel meter, used not only in the electricity transmission and power distribution system but also in the power consumption measurement and analysis in high voltage intelligent power grid.

This document provides operating, maintenance and installation instructions for the SMARTconenct X835. The unit measures and displays the characteristics of single phase two wires and three phase four wires supplies, including voltage, frequency, current, power, active and reactive energy, imported or exported. Energy is measured in terms of kWh & kVarh. Maximum demand current can be measured over preset periods of up to 60minutes. In order to measure energy, the unit requires voltage and current inputs in addition to the supply required to power the product. The requisite current input(s) are obtained via current transformers (CT).

The SMARTconenct X835 can be configured to work with a wide range of CTs, giving the unit a wide range of operation. Built-in interfaces provide pulse and RS485 Modbus RTU outputs. Configuration is password protected.

1.1 Unit Characteristics

The SMARTconenct X835 can measure and display:

- Line voltage and THD% (total harmonic distortion) of all phases
- Line Frequency
- Currents, Current demands and current THD% of all phases
- Power, maximum power demand and power factor
- Active energy imported and exported
- Reactive energy imported and exported

The unit has password-protected set-up screens for:

- Changing password
- Supply system selection 1phase2wire, 3phase 4wires
- CT Ratio and secondary current
- PT Ratio and secondary voltage
- Demand Interval time
- Reset for demand measurements
- Pulse output duration

A pulse output indicates real-time energy measurement. An RS485 output allows remote monitoring from another display or a computer.

1.2 Current Transformer Current ratio

The unit can be configured to operate with a CT ratio which is calculated by dividing the primary and secondary current (100/5A CT would be 20 as 100÷5=20). You can select for the CT Rate between 1 and 2000 and for the CT secondary you can select 1 or 5A.

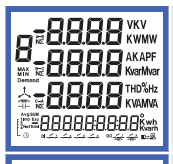
1.3 RS485 Serial – Modbus RTU

This uses an RS485 serial port with Modbus RTU protocol to provide a means of remotely monitoring and controlling the SMARTconnect X835. Set-up screens are provided for setting up the RS485 port. See section 4.8

1.4 Pulse output

This provides 2 pulsed outputs that measure active and reactive energy. The constant for reactive energy is 5000imp/kVarh. The pulse width for active energy can be set from the Set-up menu.

2 Start Up Screens

	The first screen lights all display segments and can be used as a display check
	The second screen indicates the firmware installed in the unit and its build number.
	Next the unit performs a self-test and indicates if the test passes.

*After a short delay, the screen will display active energy measurements.

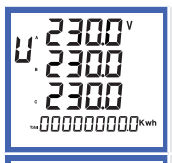
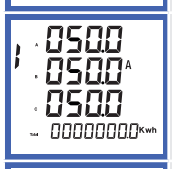
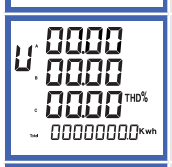
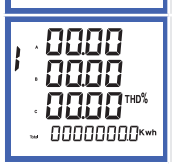
3 Measurements

The buttons operate as follows:

U/I ESC	Selects the Voltage and Current display screens. In Set-up Mode, this is the “Left” or “Back” button.
M	Select the Frequency and Power factor display screens. In Set-up Mode, this is the “Up” button.
P	Select the Power display screens. In Set-up Mode, this is the “Down” button.
E	Select the Energy display screens. In Set-up mode, this is the “Enter” or “Right” button.

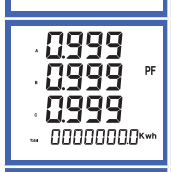
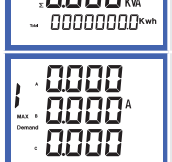
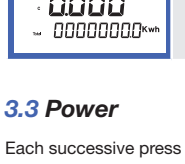
3.1 Voltage and Current

Each successive press of the U/I button selects a new parameter:

	Phase to neutral voltages.
	Current on each phase.
	Phase to neutral voltage THD%.
	Current THD% for each phase.

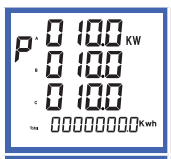
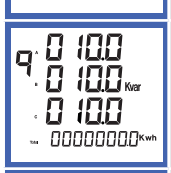
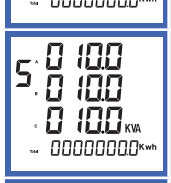
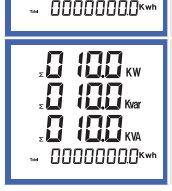
3.2 Frequency and Power Factor and Demand

Each successive press of the M button selects a new range:

	Total kW Frequency Power factor (total)
	Power factor of each phase
	Maximum Power Demand.
	Maximum Current Demand.

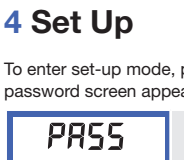
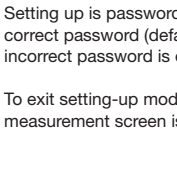
3.3 Power

Each successive press of the U/I button selects a new range:

	Instantaneous active power (kW)
	Instantaneous reactive power (kVar)
	Instantaneous Volt-amps (KVA)
	Total kW, kVarh, kVA

3.4 Energy Measurements

Each successive press of the E button selects a new range:

	Imported active energy in kWh.
	Exported active energy in kWh.
	Imported reactive energy in kVArh.
	Exported reactive energy in kVArh.
	Total active energy in kWh.
	Total reactive energy in kVArh.

4 Set Up

To enter set-up mode, press and hold the E button until the password screen appears.

	Use M and P buttons to adjust the flashing digit, Press E to move to the right for the next digit selection.

Setting up is password-protected so you must enter the correct password (default ‘1000’) before processing. If an incorrect password is entered, the display will show: PASS Err

To exit setting-up mode, press U/I repeatedly until the measurement screen is restored.

4.1 Set-up Menu Structure

	Change password 4-digit number – default ‘1000’
	Set the ratio of the CT 4-digit number 0001~2000.
	Set the ratio of PT 4-digit number 0001~2000.

DIT(Demand Integration Time). This is the period in minutes over which the current and power readings are integrated for maximum demand measurement. Options are: off, 5, 8, 10, 15, 20, 30 and 60 minutes.

4.2 Set-up Entry Methods

Some menu items, such as password and CT, require a four-digit number entry while others, such as supply system, require selection from a number of menu options.

4.2.1 Menu Option Selection

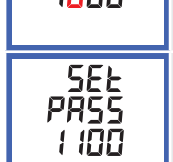
1. Use the M and P buttons to select the required item from the menu shown in section 4.1.
2. Hold E to adjust the current set-up option shown.
3. If an item flashes, then it can be adjusted by the M and P buttons. If not, there maybe a further layer.
4. Having selected an option from the current layer, hold E to confirm your selection.
5. Having completed a parameter setting, hold E to save your adjustment. You will return to the set-up menu and will be able to use the M and P buttons for further menu selection.
6. On completion of all setting-up, press U/I repeatedly until the measurement screen is restored.

4.2.2 Number Entry Procedure

When setting up the unit, some screens require the entering of a number. In particular, on entry to the setting up section, a password must be entered. Digits are set individually, from left to right. The procedure is as follows:

1. The current digit to be set flashes and is set using the M and P buttons.
2. Once you have set the flashing number press the E button to move along to the next digit.
3. After setting the last digit, hold the E button to confirm your selection. Once the selection stops flashing the selection will be saved.

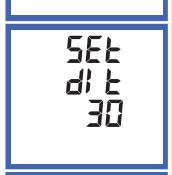
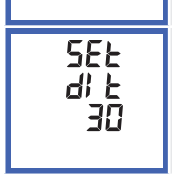
4.3 Change Password

	Use the M and P to choose the change password option.
	Hold the E button to enter the change password. The new password screen will appear with the first digit flashing.
	Use M and P to set the first digit and press E to move to the next digit.
	Repeat the procedure for the remaining three digits.
	Hold E to confirm the selection. Once the selection stops flashing the selection will be saved.

You will now return to the set up menu, using the M and P buttons will allow you to scroll through the other set-up options.

4.4 DIT Demand Integration Time

This sets the period in minutes over which the current and power readings are integrated for maximum demand measurement. The options are: 0 (off), 5, 8, 10, 15, 20, 30 and 60 minutes.

	From the set-up menu, use M and P buttons to select the DIT option. The screen will show the currently selected integration time.
	Hold E to enter the selection. The current time interval will flash.
	Use the M and P buttons to select the time required.
	Hold E to confirm the selection. Once the selection stops flashing the selection will be saved.

Warnings

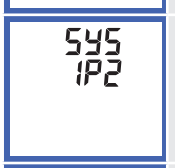
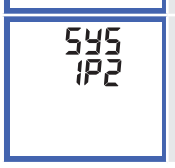
Important Safety Information is contained in the Maintenance section. Familiarize yourself with this information before attempting installation or other procedures. **Symbols used in this document:**

Risk of Danger: These instructions contain important safety information. Read them before starting installation or servicing of the equipment.

Caution: Risk of Electric Shock

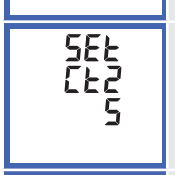
4.5 Supply System

Use this section to set the type of power supply being monitored. Please note this product will not work as a 3-phase 3-wire system.

	From the set-up menu, use M and P buttons to select the system option. The screen will show the currently selected power supply.
	Hold E to enter the selection. The current selection will flash.
	Use M and P buttons to select the required system option: 1P2(Single Phase) 3P4(3 Phase 4 Wire).
	Hold E to confirm the selection. Once the selection stops flashing the selection will be saved.

4.6 CT

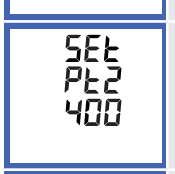
The CT option sets the current transformer rate (1~2000) and secondary current (CT2 1A or 5A) of the current transformer (CT) that is connected to the meter.

	From the set-up menu, use M and P buttons to select the CT option. The screen will show the CT secondary current value.
	**Secondary CT setting** Hold E to adjust the CT secondary current value (1A or 5A).
	Set CT Rate value Hold E to adjust the CT Rate setting screen. The range is from 0001 to 2000 (allowing up to a 10000/5A CT).

To work out your CT rate, divide your CT Primary current value by your CT Secondary current value. For example, using a 100/5A CT would have a CT rate of 20 (100÷5=20).

4.7 PT

The PT option sets the secondary voltage (PT2 100~500V) of the Voltage transformer (PT) that connects to the meter.

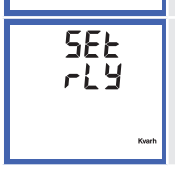
	From the set-up menu, use M and P buttons to select the PT option. The screen will show the voltage PT secondary value.
	Hold E to adjust the selection, use the M and P buttons to set the correct secondary value, hold E to confirm the selection.
	Hold E to adjust the PT rate. The range is from 0001 to 9999, use the M and P buttons to set the correct PT rate.

*To work out your PT rate, divide your PT primary current value by your PT secondary current value.

Hold E to confirm the selection. Once the selection stops flashing the selection will be saved.

4.8 Pulse Output

This option allows you to configure the pulse output. The output can be set to provide a pulse for a defined amount of active or reactive energy. Use this section to set up the relay pulse output—Available units: kWh, kVArh.

	From the set-up menu, use M and P buttons to select the Pulse output option.
	Hold E to enter the selection. The unit symbol will flash.
	Use M and P buttons to choose kWh or kVArh.

Hold E to confirm the selection. Once the selection stops flashing the selection will be saved.

4.8.1 Pulse rate

Use this to set the energy represented by each pulse. Rate can be set to 1 pulse per 0.001Wh/0.01kWh/0.1kWh/1kWh/10 kWh/100kWh. (It shows 1 impulse = 1Wh/kVarh)

From the set-up menu, use M and P buttons to select the Pulse Rate option.

Hold E to enter the selection. The current setting will flash.

Use M and P buttons to choose pulse rate. 0.001/0.01/0.1/1/10/100kWh/kVarh per pulse. On completion of the entry procedure, hold E to confirm the setting, once the selection stops flashing the selection will be saved.

4.8.2 Pulse Duration

The energy monitored can be active or reactive and the pulse width can be selected as 200, 100 or 60ms. (It shows pulse width of 200ms)

From the set-up menu, use M and P buttons to select the Pulse width option.

Hold E to enter the selection. The current setting will flash.

Use M and P buttons to choose pulse width (200/100/60ms). On completion of the entry procedure, hold E to confirm the setting, once the selection stops flashing the selection will be saved.

4.9 Communication

There is an RS485 port that can be used for communication using Modbus RTU protocol.

4.9.1 RS485 Address

From the set-up menu, M and P buttons to select the address ID.

Hold E to adjust the selection. The current setting will be flashing.

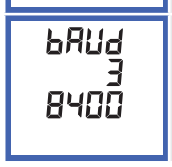
Use M and P buttons to choose Modbus address (001 to 247).

On completion of the entry procedure, hold E to confirm the setting, once the selection stops flashing the selection will be saved.

4.9.2 Baud Rate

From the set-up menu, use M and P buttons to select the Baud Rate option.

Hold E to adjust the selection. The current setting will flash.



Use M and P buttons to choose Baud rate 2.4k. 4.8k, 9.6k, 19.2k, 38.4k

On completion of the entry procedure, hold E to confirm the setting, once the selection stops flashing the selection will be saved.

4.9.3 Parity

From the set-up menu, use M and P buttons to select the parity option.

Hold E to adjust the selection. The current setting will flash.

Use M and P buttons to choose the relevant parity (EVEN/ODD/ NONE)

On completion of the entry procedure, hold E to confirm the setting, once the selection stops flashing the selection will be saved.

4.9.4 Stop bits

From the set-up menu, use M and P buttons to select the stop bit option.

Hold E to enter the selection. The current setting will flash.

Use M and P buttons to choose the relevant stop bit (2 or 1)

On completion of the entry procedure, hold E to confirm the setting, once the selection stops flashing the selection will be saved.

4.10.1 CLR kWh

From the set-up menu, use M and P buttons to select the reset option.

Hold E to adjust the selection. The CLR will flash.

On completion of the entry procedure, hold E to confirm the setting, once the selection stops flashing the selection will be saved.

4.10.2 CLR KVarh

From the set-up menu, use M and P buttons to select the reset option.

Hold E to adjust the selection. The CLR will flash.

On completion of the entry procedure, hold E to confirm the setting, once the selection stops flashing the selection will be saved.

4.10.2 CLR Max Demand

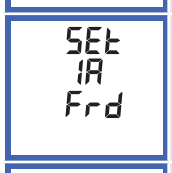
From the set-up menu, use M and P to select the reset option.

Hold E to adjust the selection. The CLR will flash.

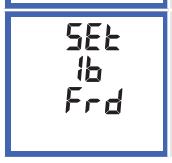
On completion of the entry procedure, hold E to confirm the setting, once the selection stops flashing the selection will be saved.

4.11 Reverse Connected Current Inputs Correction Setting

From the set-up menu, use M and P to select page “SET SYS COnt”



Hold E to access the sub-option menu, use M and P to view Phase A, B & C. The default is frd (forward)



Hold E to adjust the selection. Use M and P to change between FRD and REV. Hold E to confirm the selection. Once the selection stops flashing the selection will be saved.

4.12 Setting Auto Scroll Display Interval

Use the M and P to find “SET AUTO”, hold E to adjust the selection. The current option will appear with the first digit flashing.

Use M and P to set the first digit and press E to confirm your selection. The next digit will flash.

Repeat the procedure for the remaining three digits.

Hold E to confirm the selection. Once the selection stops flashing the selection will be saved.

After setting, you still need to activate the auto scroll display function by repeatedly pressing the ESC button. If you wish to exit from the auto scroll function, you can press the ESC button.

5 Specifications

5.1 Measured Parameters

The unit can monitor and display the following parameters of a single phase, 3-phase 3-wire or 3-phase 4-wire supply.

5.1.1 Voltage and Current

- Phase to neutral voltages 100 to 289V a.c. (not for 3p3w supplies)
- Voltages between phases 173 to 500V a.c. (3p supplies only)
- Percentage total voltage harmonic distortion (THD%) for each phase to N (not for 3p3w supplies)
- Percentage voltage THD% between phases (three phase supplies only)
- Current on each phase – 1 to 9999A range, set by external current transformer(s) (CTs)
- Current THD% for each phase

5.1.2 Power factor, Frequency and Max Demand

- Frequency in Hz
- Instantaneous power
- Power 0 to999MW
- Reactive Power 0 to 999MVAr
- Volt-amps 0 to 999 MVA
- Maximum demanded power since last Demand reset Power factor
- Maximum neutral demand current, since the last Demand reset (three phase supplies only)

5.1.3 Energy Measurements

• Imported active energy	0 to 9999999.9 kWh
• Exported active energy	0 to 9999999.9 kWh
• Imported reactive energy	0 to 9999999.9 kVArh
• Exported reactive energy	0 to 9999999.9 kVArh
• Total active energy	0 to 9999999.9 kWh
• Total reactive energy	0 to 9999999.9 kVArh

5.2 Measured Inputs

The measured voltage input is a 4-way plug-in terminal with 2·5mm² stranded wire capacity. This device can be configured as 3-phase 4-wire or as a single-phase 2-wire set up. The CT input is a 6-way plug-in terminal with 2·5mm² stranded wire capacity. Nominal rated input current 5A or 1A via an external CT.

5.3 Accuracy

• Voltage	0·5% of range maximum
• Current	0·5% of nominal
• Frequency	0·2% of mid-frequency
• Power factor	1% of unity (0.01)
• Active power (W)	±1% of range maximum
• Reactive power (VAr)	±2% of range maximum
• Apparent power (VA)	±1% of range maximum
• Active energy (Wh)	Class 1 IEC 62053-21
• Reactive energy (VARh)	±2% of range maximum
• Total harmonic distortion	1% up to 31st harmonic
• Temperature co-efficient	Voltage and current = 0.013%/°C typical
• Active energy	= 0·018%/°C, typical
• Response time to step input	1s, typical, to >99% of final reading, at 50 Hz.

5.4 Auxiliary Supply

This device is a self-supplied meter due to internal links on terminals 1 and 6. This device does not require an external auxiliary supply.

5.5 Interfaces for External Monitoring

Three interfaces are provided:

- RS485 communication channel that can be programmed for Modbus RTU protocol
- Relay output indicating real-time measured energy. (configurable)
- Pulse output 5000imp/kWh (not configurable)

The Modbus configuration (Baud rate etc.) and the pulse relay output assignments (kW/kVArh, import/export etc.) are configured through the Set-up screens.

5.5.1 Pulse Relay Output

Opto-coupler with potential free SPST-NO Contact (Contact range 5-27VDC / Max current input: Imin 2mA and Imax 27mA DC). The pulse output can be set to generate pulses to represent kWh or kVArh.

Rate can be set to generate 1 pulse per:
0.01 = 10 Wh/VArh
0.1 = 100 Wh/VArh
1 = 1 kWh/kVArh
10 = 10 kWh/kVArh
100 = 100 kWh/kVArh

Pulse width: 200/100/60 ms.

5.5.2 RS485 Output for Modbus RTU

For Modbus RTU, the following RS485 communication parameters can be configured from the set-up menu:

Baud rate 2400, 4800, 9600, 19200, 38400

Parity none / odd / even

Stop bits 1 or 2

RS485 network address nnn – 3-digit number, 1 to 247

Modbus™ Word order Hi/Lo byte order is set automatically to normal or reverse. It cannot be configured from the set-up menu.

5.6 Reference Conditions of Influence Quantities

Influence Quantities are variables that affect measurement errors to a minor degree. Accuracy is verified under nominal value (within the specified tolerance) of these conditions.

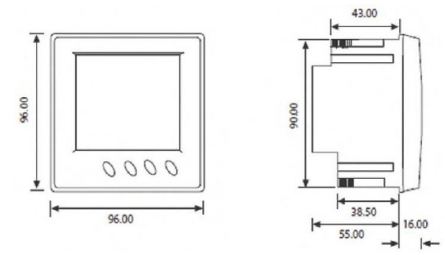
• Ambient temperature	23°C ±1°C
• Input waveform	50 or 60Hz ±2%
• Input waveform	Sinusoidal (distortion factor < 0·005)
• Auxiliary supply voltage	Nominal ±1%
• Auxiliary supply frequency	Nominal ±1%
• Auxiliary supply waveform (if AC)	Sinusoidal (distortion factor < 0·05)
• Magnetic field of external origin	Terrestrial flux

5.7 Environment

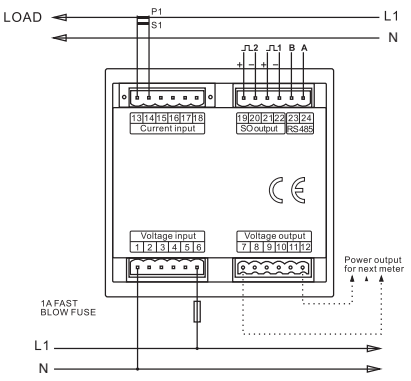
• Operating temperature	-25°C to +55°C*
• Storage temperature	-40°C to +70°C*
• Relative humidity	0 to 90%, non-condensing
• Altitude	Up to 2000m
• Warm up time	1 minute
• Vibration	10Hz to 50Hz, IEC 60068-2-6, 2g
• Shock	30g in 3 planes

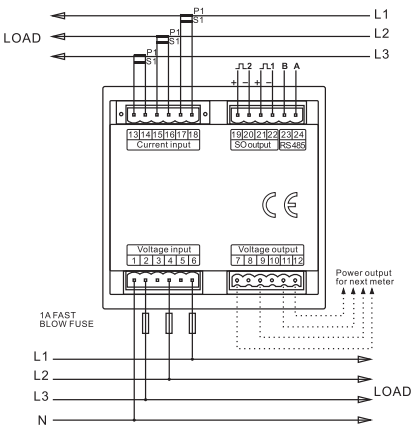
*Maximum operating and storage temperatures are in the context of typical daily and seasonal variation.

6 Dimensions

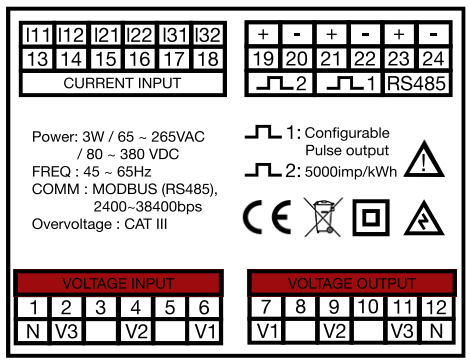


7 Wiring Diagram





Label on the back of the meter:


I11 I12 I21 I22 I31 I32
13 14 15 16 17 18
CURRENT INPUT
+ - + - + -
19 20 21 22 23 24
2 1 RS485
Power: 3W / 65 ~ 265VAC
/ 80 ~ 380 VDC
FREQ : 45 ~ 65Hz
COMM : MODBUS (RS485),
2400~38400bps
Overvoltage : CAT III
1: Configurable Pulse output
2: 5000imp/kWh
VOLTAGE INPUT
1 2 3 4 5 6
N V3 V2 V1
VOLTAGE OUTPUT
7 8 9 10 11 12
V1 V2 V3 N